Snell Practicum

Purpose

The purpose of this experiment is to demonstrate your knowledge of refraction and reflection by directing a laser beam to selected targets. You may work in groups of two. Although you may work alone, it is not recommended. No groups of four or more are allowed.

Equipment

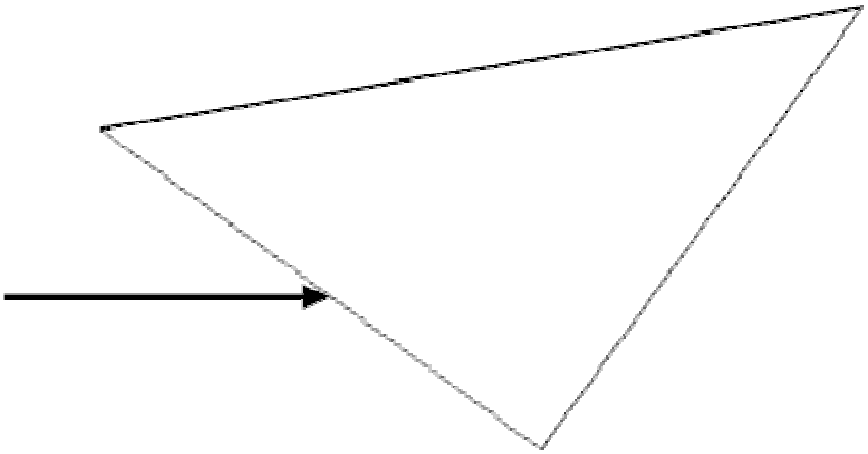
Each group will be provided with the following equipment:

- 45-45-90º isosceles right prism model
- rulers and/or meter sticks
- protractors
- table diagram with selected targets
- graph
- paper (if requested)

Procedure

Part I:

As a preliminary exercise, you are to complete drawing the path of the ray through the following prototype using the fact that the prism has a 1.45 index of refraction. Carefully draw in each dotted normal and clearly label all angles. When you are done with you diagram, have your teacher initial and date it before proceeding to part II.

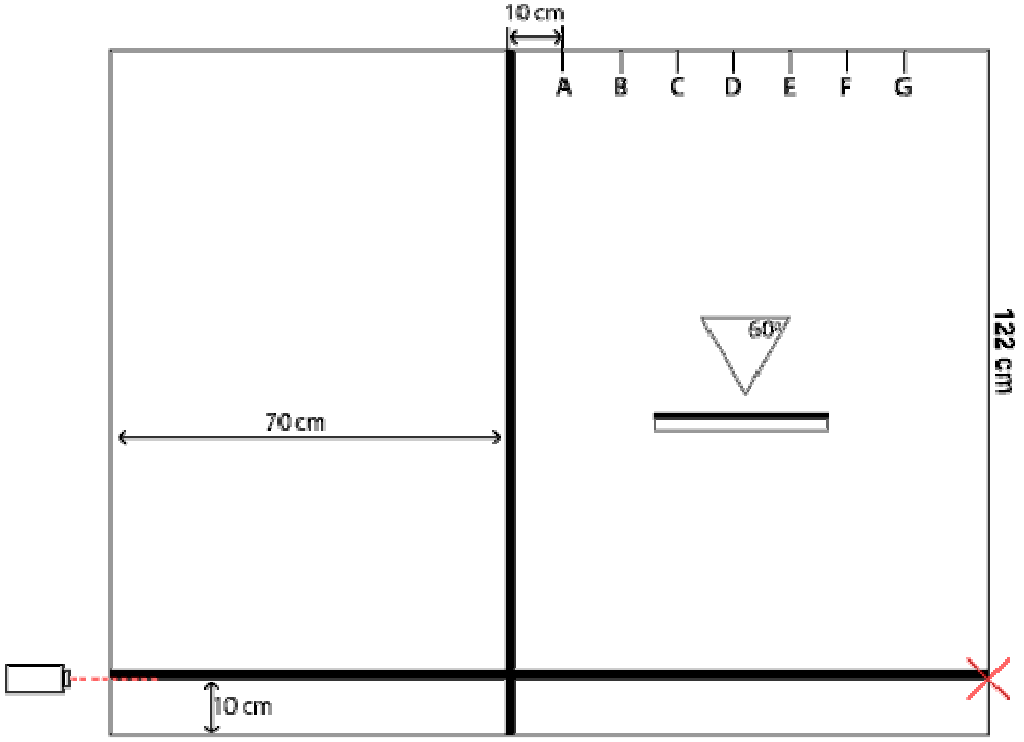


Refer to the following information for the next question.

Completion of practice triangular prism diagram

Part II:

You will be provided with a table diagram showing the position and height of the laser as well as your circled target position.



Using Snell's Law, the Law of Reflection, and the knowledge gained from your diagram in Part I, you are to calculate and diagram the path of the laser's beam through the prism to its target letter (D through G).

Once you have done your calculations, each group will set up their prism on the testing table and I will turn on the laser one time. We will record where your beam strikes the target wall. If you are not successful, you will be allowed to recalculate your prism's orientation and position and try a second time.

Refer to the following information for the next four questions.

Using the prism to send the beam to its pre-selected target letter.

Our group's pre-selected target letter was ____

First attempt: our beam missed the target by ____ cm.

Second attempt: our beam missed the target by ____ cm.

Third attempt: our beam missed the target by ____ cm.

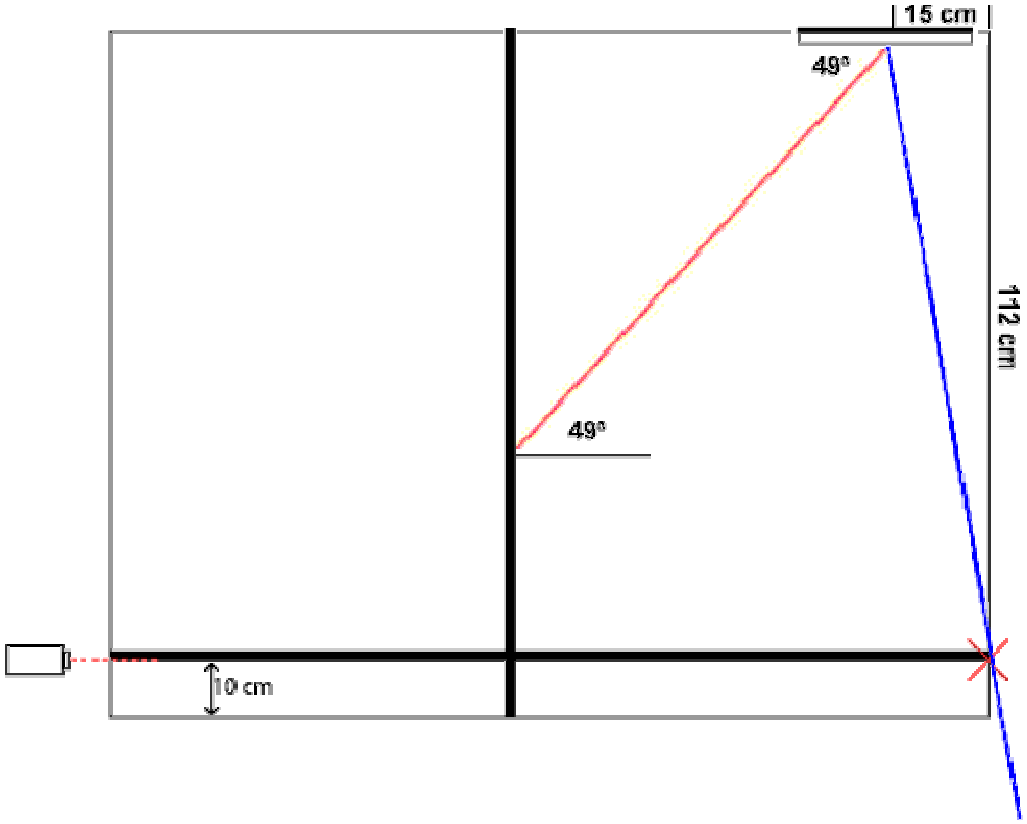
Evaluation:

Your grade is based on your supporting calculations, your ray diagrams, and the number of trials required to successfully reach your pre-selected target letter.

Each team's work must be completed and turned in the basket before leaving the classroom.

Further suppose that the center of the mirror is 15 cm from the edge of the table and 112 cm from the laser's final destination.

Show how you would pivot the mirror to get the incoming beam to be correctly reflected (remember you cannot pivot the red beam, only the mirror). Show your calculations as well as a supporting diagram. Be sure to carefully construct the dotted normal and to measure the angles of incidence and reflection.



Refer to the following information for the next question.

Completion of practice plane mirror diagram

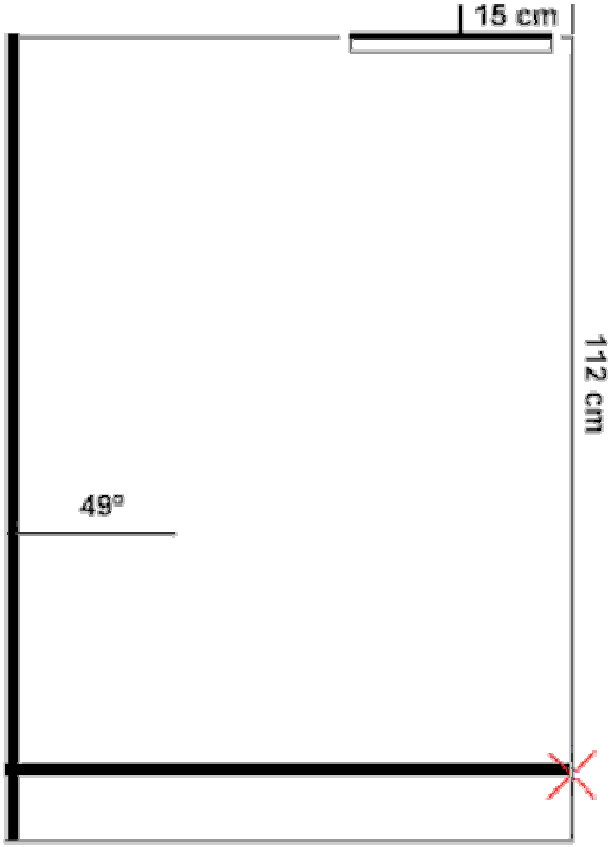
Evaluation:

Your grade is based on your supporting calculations, your ray diagrams, and the number of trials required to successfully reach your pre-selected target letter.

Each team's work must be completed within the testing period and turned in to the one-way box before leaving the classroom.

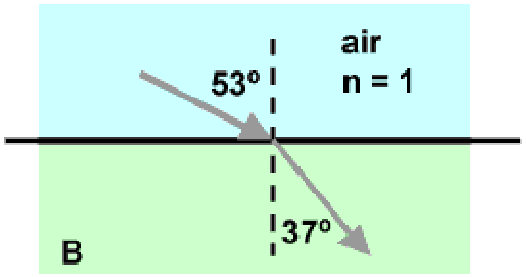
Snell's Law is stated as $\mathbf{n_1 \sin(\theta_1) = n_2 \sin(\theta_2)}$ where

- n_1 is the index of refraction for the first medium
- n_2 is the index of refraction for the second medium
- that angles θ_1 and θ_2 are always measured from the normal, NEVER from the interface.

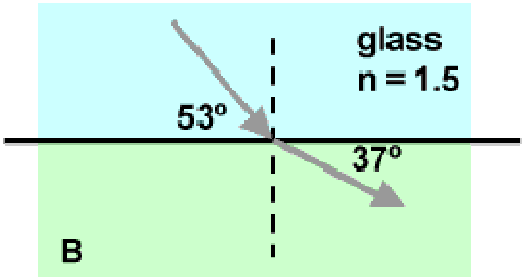


Problems

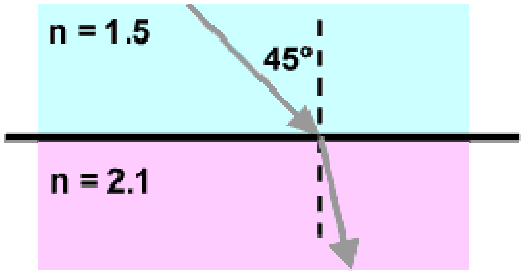
1. Using the information given in the following diagram, calculate the optical index of refraction for medium B.



2. Using the information given in the following diagram, calculate the optical index of refraction for medium B.



3. Using the information given in the following diagram, calculate the angle of refraction in the lower medium.



4. A ray of light strikes a piece of glass (n = 1.5), making an angle of 30o with the surface. What angle does the refracted ray make <u>with the surface inside the glass</u>?